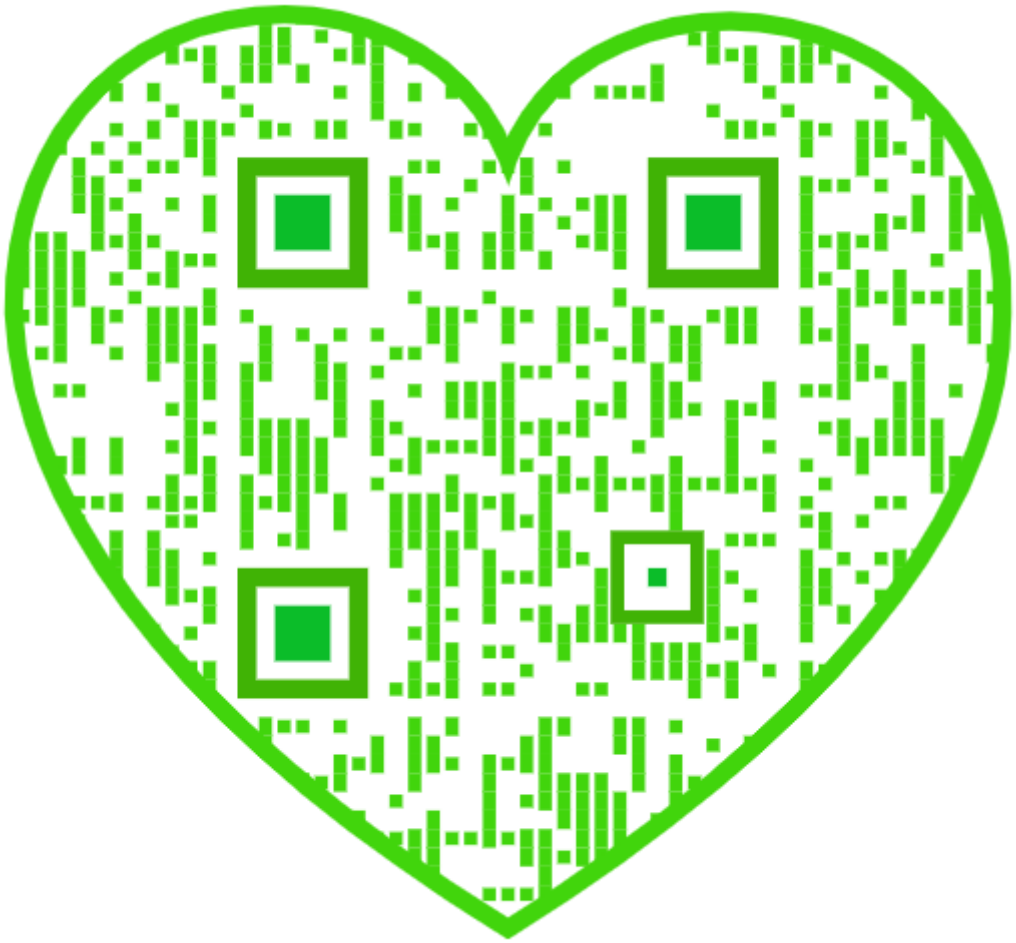

A Compend of Operative Gynecology

Based on Lectures in the Course of Operative Gynecology on the Cadaver at the New York Post-Graduate Medical School and Hospital

Delivered by

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PREFACE.

The primary object of the book is to serve as an aid to the students taking the Course in Operative Gynecology on the Cadaver at the New York Post-Graduate Medical School and Hospital. It is brief and necessarily incomplete—it is not intended to be otherwise. It has been written in response to repeated requests from students who have felt the need of some such work. The operations are presented in the order in which they are usually described to the classes, the object of such an arrangement being to make the best possible use of each cadaver.

The gynecologist is an abdominal surgeon, and as such must be competent to cope with any intra-abdominal condition that may be met with. The Exploration of the Viscera, therefore, forms a most valuable adjunct to the course, in that familiarity with the normal appearance and relations of the various abdominal organs is an absolute essential to successful surgery.

It is hoped that this book will prove of value for subsequent reference to those who have been students at the Post-Graduate Medical School and Hospital, and that others may find something of worth between its covers.

W. S. B.
H. D. M.

New York, May, 1906.

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A Compend of Operative Gynecology

EXTRA-PERITONEAL SHORTENING OF ROUND LIGAMENTS.

Alexander Operation (Modified). *Anatomy:* The round ligaments restrain the uterus from excessive backward movement. They spring from the uterine cornua, just in front and below the origin of the Fallopian tubes. Passing forward in the folds of the broad ligaments, they emerge from the abdominal cavity through the internal abdominal rings, enter the inguinal canals and pass to the external abdominal rings. Each ligament is attached in five ways: (1) To the uterus; (2) to the inferior wall of the inguinal canal by numerous fibrous bands; (3) to the tissues around the external ring; (4) to the spine of the os pubis; (5) to the labium major.

The external ring lies just above and a little to the outer side of the spine of the pubis; the internal ring lies three inches to the outer side of the spine of the pubis and a half inch above Poupart's ligament.

The inguinal canal lies between the internal and external rings and is limited by them.

Technic: An incision two inches long is made, extending upward and outward from the pubic spine, forming an angle of ten degrees with Poupart's ligament. The incision should lay bare the tendon of the external oblique, exposing the external ring. After incising the fascia covering the external ring downward pressure on the abdominal wall near the in-

cision will cause the protrusion of a small fatty ball which covers the ligament between the pillars of the ring. Passing a hook beneath this fat, the ligament is raised and separated from surrounding tissue. It is then seized with forceps and traction made toward the opposite mid-thigh, i.e., in the direction of the canal. The fibrous attachments between the ligament and the inferior wall of the canal may be divided with a director or blunt-pointed bistoury.

In separating the ligament and drawing it out, care should be taken to avoid injuring the ilio-inguinal and genital branch of the genito-crural nerves. They are usually situated to the outer side of the ligament, the former being larger and more superficial.

After freeing the ligament a ligature or strip of gauze is passed loosely around it and the wound covered while the opposite ligament is isolated. Sufficient traction is then made on both ligaments to draw the fundus into an exaggerated anterior position, as ascertained by a vaginal examination made by an assistant. The appearance of the "peritoneal cuff" indicates a safe limit. The slack ligament is then cut away and the remaining portion anchored in the external ring in the following manner: A suture is passed through the external pillar, including the outer half of the ligament; a second suture is passed through the internal pillar and the inner half of the ligament; a third suture is passed through the lower half of the cut extremity, securing it to the lower angle of the ring; a fourth suture unites the upper half of the ligament to the upper angle of the ring. In this method there is no constriction of the ligament.

Chromic catgut, kangaroo-tendon or silk may be used for suture material. The abdominal wound is

closed in the usual manner, covering with gauze a
so bandaged as to prevent exposure of the wound b
movements of the patient.

After-treatment: The bladder should be emptied
at intervals of four, five, six, seven and eight hours
respectively for the first five days. The wearing of a
pessary one or two months after operation is a rule,
though usually unnecessary, precaution.

Adams makes a smaller incision over the external
ring, usually within the hair line.

Edebohls splits up the entire inguinal canal, draws
the ligament out at the internal ring, closes the wound
as in the Bassini operation for inguinal hernia.

Newman incises over the internal ring, draws the
ligament straight out and secures it in the wound.

Martin and **Duret** pass drawing forceps (Lennox)
skin and subcutaneous tissue of the same [illegible]
draw the ligaments through to the wound of the [illegible]
posite side, where they are fixed.

Indications: The uterus should be small and [illegible]
movable. Inflammation of the appendages, adhesions
or any impediment to replacement are [illegible]
indications.

Objections: (1) Two incisions are necessary; [illegible]
the ligaments are often attenuated and [illegible]
(3) hydrocele of the ligament and [illegible]
have occurred.

EXCISION OF [illegible]

Meyer. *Technique:* The [illegible]
breadth below the insertion of the [illegible]
on the humerus, extends [illegible]
axilla to the edge of the [illegible]
the lower edge of the [illegible]

the sternum. The skin of the lower flap is dissected loose and turned down to the border of the latissimus dorsi, as much subcutaneous fat as possible being left to the breast and axillary tissue. An upper flap is made by continuing the axillary incision around the upper part of the breast to meet the lower incision over the sternum.

Hemorrhage is best controlled by the pressure of hot towels, the clamping of small vessels being a waste of time.

The pectoralis major is cut away from its humeral attachment, hemorrhage being controlled by whipping the cut attachment with a catgut suture. The muscle is turned back and the axillary vein exposed. The vein lies to the thoracic side of the artery and partially overlaps it. The dissection is carried up to the insertion of the pectoralis minor, the attachment of which is cut, the muscle turned back, and removed down to its thoracic attachment, care being taken not to injure the subclavian vein which lies beneath the tendon. The costo-coracoid membrane is removed. Special precaution should be taken not to injure the cephalic vein which pierces it. The employment of force may drag this vein from its attachment to the axillary and be productive of much harm. The saving of the other vessels and the anterior thoracic nerve which pass through the structure is of lesser importance. The axillary vein is cleaned by a sharp dissection.

The subclavicular, infraclavicular and axillary fat, glands and lymphatics are excised, beginning over the nerve bundles high up in the cavity and continuing down from the lower border of the subclavian and axillary veins.

The lymph glands should be removed from Mohrenheim's space. This space is bounded by the clavicle above, the pectoralis minor and costo-coracoid membrane in front and externally, the chest wall behind and internally..

The posterior or long thoracic and the long or middle subscapular nerves should be preserved. The former passes behind the brachial plexus and axillary vessels, down the side of the thorax upon the serratus magnus muscle, which it supplies. When this is destroyed the patient is unable to raise the arm above a right angle. The mid-subscapular nerve follows the course of the subscapular artery along the posterior wall of the axilla to the latissimus dorsi, which it supplies. Injury to this nerve interferes with backward motion, adduction and inward rotation of the humerus.

After the axilla has been cleaned the pectoralis minor in part, pectoralis major, subcutaneous fat and the breast are lifted *en masse* and separated from the chest wall by working from before backward toward the axilla. This obviates any chance of forcing cancerous elements through the lymphatics situated at the inner side of the breast which pass through the intercostal spaces to reach the anterior mediastinal glands.

The perforating thoracic vessels should be located and ligated as the muscle is lifted from the chest wall. If these are torn or cut close to the chest wall before ligation, the open mouths of the vessels are apt to retract and give rise to troublesome hemorrhage. Should this accident occur, a needle threaded with catgut should be passed in the neighborhood of the bleeding point and the ligature tied. The fascia over the intercostal muscles should also be removed.

The operation is completed by drawing the lower skin flap upwards and inwards and closing the wound up to a point of tension by a suture starting at the humeral extremity of the wound. Tension should be diminished by freeing the skin from its attachment for two or three inches around the cut margin. The rest of the wound is closed in such a manner as to leave a triangular area unclosed over the remaining portion of the pectoralis minor. This is covered with skin grafts planted on the muscle.

A drainage tube is inserted in the most dependent portion of the axilla, the opening through the skin being made in antero-posterior direction in order to permit the ready approximation of the edges after removal of the tube.

Halsted-Meyer. The *technic* is essentially the same as described in the Meyer operation with the following differences: Halsted makes an oval incision, does not take away the clavicular portion of the pectoralis major, but does remove all of the pectoralis minor. If the Halsted operation is done, the chain of lymphatics going down between the clavicular and thoracic portions of the pectoralis major should be removed when the thoracic portion of this muscle is taken away. Unless there is an exceptional amount of skin involvement, Halsted does not remove the entire area over the breast but leaves a sufficient amount to permit a closure of the wound, thus rendering skin-grafting unnecessary.

SALINE INFUSION.

The veins of the forearm group themselves in a general way into three sets: (1) median, (2) ulnar or internal, (3) radial or external.

The central group join, and at the extreme lower and outer edge of the tendon of the biceps form one large vein, the median basilic. This is usually constant from the same point.

The ulnar group forms a vein which unites with the median basilic to form the basilic vein just above the internal epicondyle.

The radial group forms a vein which in turn unites with a vein from the median group, the median cephalic, which starts at the point where the median basilic began, passes outward almost parallel with the biceps tendon, over the cubital space to the outer side of the biceps muscle, on a level with the external epicondyle.

Infusion is usually done into the median basilic or median cephalic veins. The former is larger, easier to find and is easily steadied on the tendon of the biceps, upon which it rests. It is separated from the brachial artery by the biceps tendon. Filaments of the internal cutaneous nerve cross over the vein at its upper part. The external cutaneous nerve passes under the median cephalic vein at about its middle.

Technic: An incision one inch long is made from the lower and outer edge of the biceps tendon, passing upward and inward across to the inner margin of the tendon, at the level of a line drawn from the internal to the external epicondyle. The incision is superficial, for the vein lies directly on the tendon of the biceps.

After exposing the vein, two catgut ligatures a half inch apart are passed under it and the distal ligature tied. The vein is seized above the ligature with a pair of fine dissecting forceps and an oblique cut made into it with scissors, dividing it half way across. While retaining hold with the forceps of the triangular flap

thus made, a canula is introduced into the vein and secured in position by tying the proximal ligature. The canula is inserted while saline is running through it to avoid forcing air into the vein. After a sufficient quantity of saline has been introduced, the canula is withdrawn and the upper ligature tightened. The skin wound is closed with two or three stitches.

The incision for the median cephalic vein is made from the lower and external margin of the biceps tendon upward and outward to the level of a line drawn from the external to the internal epicondyle, along the edge of the biceps tendon.

NOTE.—The saline should be .9 per cent. (approximately a teaspoonful and a half of sodium chlorid to a pint of water). It should be at a temperature of 100° when it enters the circulation. The vein should be found by anatomical outlines and not by placing a temporary constricting band on the arm to cause a swelling of the vein. To further reduce blood in the main centres of the body even to the extent necessary to swell the veins of the arm may be dangerous.

SKIN-GRAFTING (Thiersch).

Technic: The skin of a non-hairy part of the body, previously prepared, is made tense, using McBurney retention hooks or sharp retractors. If specially devised instruments are not available sufficient tension may be made with the hands. The razor is held flat, and half the thickness of the skin cut through in the long axis of traction by a to-and-fro movement. The strips may be cut one-half to two or more inches in width, as desired. As the skin is cut it is drawn upon the razor-blade by a tenaculum in the hands of an assistant.

This procedure is facilitated by allowing a gentle stream of saline to play upon the cut skin. The graft is retained on the razor. When a proper length has been cut, the skin is divided with scissors or by slightly elevating the razor edge. The skin section is best transferred immediately to the field to be covered and gently teazed into position. The grafts are covered by narrow overlapping strips of rubber tissue wet in saline. These adapt themselves to surface irregularities and permit secretions to pass between them. If there is no sign of infection the original dressing should not be disturbed for a week.

NOTE.—To insure the grafts "taking," absolute hemostasis of the field to be covered must be secured. Air bubbles, blood and foreign bodies must be removed from beneath the sections.

When impracticable to transplant grafts at once they should be placed in warm saline and used as soon as possible.

The sections will curl toward the cut surface.

DILATATION AND CURETTAGE.

Technic: The vulva is shaved. The hair over the mons veneris may be simply covered. Parts thoroughly cleansed. The perineum is retracted by a self-retaining speculum and the anterior lip of the cervix grasped by bullet forceps and drawn downward. Any cervical erosion or ulceration is treated with carbolic acid or iodin before the direction of the uterine canal is confirmed and the depth determined by introduction of a sound. Cervical erosions may be curetted; if curetted, the vagina must be again thoroughly cleansed.

A dilator of the Goodell pattern (blades diverging

parallel to each other) is introduced and the dilatation obtained by the intermittent force of the hand-squeeze, exerted in all directions. Ten to fifteen minutes should be employed for a proper dilatation, the degree varying from half an inch to one inch. Force should never be exerted in introducing the dilator, as there is danger of seriously injuring the uterus by making a false passage. If the dilator is introduced with difficulty the cervix should be allowed to recede and counter-pressure obtained by putting the vagina on the stretch, rather than by exerting pressure against the bullet forceps. This precaution will obviate the danger of a sudden slipping out of the dilator with a resulting tear, as well as the danger of ripping through the anterior lip of the cervix with the bullet forceps.

Vaginal counter-pressure is contra-indicated in the presence of marked inflammatory conditions of the appendages. Pressure against the urethra and clitoris with the handles of forceps must be strictly avoided.

After sufficient cervical dilatation has been accomplished, a sharp curet is introduced to the fundus and withdrawn in such way that the cutting edge scrapes along the endometrium in a straight line. Particular attention should be paid to the lateral angles and tubal openings. The tendency to curet too extensively on the posterior wall should be avoided. If the maximum force of the down stroke is exerted just above the internal os it will result in a gouging out of the myometrium at this point. In hard uteri, such as the sterile, the fibroid, and the subinvoluted of long standing, a grating sensation will be felt at points from which endometrium has been removed. In cases of cancer, sepsis, puerperal and other soft uteri, a nice touch alone will govern exactly the depth

to which the scraping should proceed. The softer the uterus the larger should be the curet.

After the curettage all *debris* and endometrium fragments should be removed by irrigation. In a large percentage of cases curetted the cervical mucosa is infected with pathogenic organisms, for which reason the application of an antiseptic, such as iodin or perchlorid of iron, is usually made. Pure carbolic or other strong caustics invite undesirable cicatrices. The application is best made by using curved uterine dressing forceps in which a pledget of cotton has been seized and twisted smoothly over the tip. After insertion into the uterus, the medication on the cotton may be evenly applied by rotating the handles in a rather wide circle. The grip of the forceps prevents the slipping off of the cotton inside the uterus. The uterine cavity should be packed only when necessary to check hemorrhage, to stimulate contraction, or to maintain dilatation. As a rule, gauze packing in the uterus hinders rather than helps drainage of its cavity, and is apt to become foul by decomposition of blood.

Dangers of the Curet: (1) Perforation of uterus. (This is especially liable to occur in soft uteri when a small curet is used. Should such an accident happen, the operation should be stopped, no irrigation used and appropriate treatment instituted to stimulate uterine contraction. If the opening is large, if omentum or intestine has been drawn into the wound or otherwise injured, if there is a condition of sepsis present, or any question of other internal injury, laparotomy should be performed at once and the damage repaired.) (2) Septic infection of uterus or its

adnexa. (3) Induction of abortion. (4) Kupture or injury to diseased or adherent appendages.

After-treatment: The patient should remain in bed five to seven days. If the uterus is enlarged or subinvoluted the time should be extended.

EXCISION OF VULVO-VAGINAL GLAND.

The vulvo-vaginal glands of Bartholin are situated on either side of the vaginal orifice, just behind the lower extremities of the bulbs. Their ducts are about half an inch long and open into the fossa navicularis, just in front of the hymen.

Technic: An incision is made at the muco-cutaneous junction into the labium over the entire length of the enlarged gland down to the wall of the sac. The wall may be readily freed by blunt dissection on all sides, except posteriorly, where it has close attachments to the deep cellular tissue under the pubic ramus. Care should be taken to avoid rupturing the sac, to avoid perforating the thin mucous surface, and to control all free hemorrhage. After the gland has been dissected out, interrupted sutures of chromicized catgut or silk are used to close the wound, the loop of each suture reaching to the bottom of the wound to bring the surfaces together, in order that no pockets may be left for the accumulation of blood. A gauze pad is placed over the wound and the sutures removed in a week.

ADHESIONS OF CLITORIS.

The most common affection of the clitoris is the presence of adhesions between the glans and the hood covering it. The adhesions, having been exposed by drawing back the prepuce, are broken up with a

probe or a grooved director. In many cases the local application of a 20 per cent. solution of cocain for ten minutes will produce sufficient anesthesia to permit a thorough operation. The exposure of the sulcus behind the corona denotes the proper degree of separation. The raw surfaces are covered with sterile vaselin or well powdered, and the patient kept quiet until walking produces no discomfort. The prepuce should be drawn back and coated with vaselin every day for a week, in order to prevent the adhesions from forming again.

CLITORIDECTOMY.

Technic: A circular incision is made through the prepuce and the lower surface of the free end of the clitoris, and carried upward along the dorsum of the clitoris close to the symphysis. The organ is then dissected out, divided close to the crura and excised from above downward. To avoid excessive hemorrhage, which often occurs from the vascular area lying just beneath the clitoris, two or three mattress sutures of catgut should be passed beneath the organ before it is cut from its bed. All active bleeding is controlled at once by the tying of these sutures. The edges of the wound are approximated by catgut sutures which pass completely under the denuded area.

After-treatment: The wound is protected with a gauze compress.

PERINEORRHAPHY.

Incomplete Laceration. *Preparatory Treatment:* The bowels are rendered as nearly empty as possible by catharsis begun two days before operation. On the day of operation repeated enemata should be

given until no more fecal matter is brought away. Any passage of fecal material during operation is liable to infect the wound and sutures, thus preventing primary union. To avoid possible contamination a small piece of gauze with tape attached is introduced into the rectum.

Technic: A silk tractor is inserted on each side at the margin of the vaginal introitus, at a point opposite the lowest of the carunculæ myrtiformes. A third tractor is inserted at the highest point of the rectocele. The two marginal tractors are crossed and drawn taut until their insertions meet at a common median point; this permits accurate determination of the size of the introitus vaginæ to be formed by the repair. In a typical laceration a triangular cleft will be found extending inward between the posterior and lateral walls of the vagina. The floor of this area is made up of scar tissue; its apex determines the upward limitation of the tear.

The area to be denuded is next marked out. By drawing the central and lateral tractors in opposite directions, the lateral margins of the triangular area of scar tissue just described may be stretched into a straight line. By connecting the points of tractor insertions with an incision extending through the mucous membrane, while the tissue is thus on the stretch, it will be found, upon relaxation, that the triangular area has been marked out with clean-cut margins, an essential to accurate approximation. This procedure is repeated on the opposite side.

Where the depth of the scar tissue prevents the angle from being brought down into a straight line, an incision may be made from the central and lateral tractors to just beyond the apex of the scar.

The lines of demarcation will now resemble a spread-out M. The points of insertion of the two lateral tractors are then connected by an incision made with a scalpel along the perineal muco-cutaneous border. The area thus marked out is denuded. If hemorrhage is troublesome, a small gauze pad should be firmly pressed on the bleeding surface and the operation proceeded with on the opposite side. By working on alternate sides the operation may proceed without delay and hemorrhage in a large measure be controlled.

After denudation has been completed, stitches are introduced as follows: The first suture is introduced at the upper angle of the wound, one-eighth of an inch from the outer margin of denudation. The needle is carried downward and outward, to encircle retracted muscle fibres and fascia, before it is passed across the floor of the tear and out on the vaginal surface opposite the original point of entrance. Sutures are thus passed and tied in each sulcus down to the vulvar end of denudation.

The first suture of the vulvar end of denudation is called the *crown stitch.* It is introduced by passing the needle through perineal tissue just below the last vaginal caruncle, across the floor of the denuded area and carrying it to, but not through, the vaginal mucous membrane near the tip of the rectocele. The needle is then carried across just below the mucous membrane, passed downward below the opposite cut margin of rectocele, outward across the denuded floor and upward below the vaginal caruncle opposite the original point of introduction.

To safeguard against injury to the bowel, the gloved finger may be held in the rectum while the stitches are being introduced. After the stitches have

been passed the finger is withdrawn and the glove removed by grasping it by the wrist-band and turning it inside out. The operation is continued with one ungloved hand.

The operation is completed by the closure of the cutaneous surface with two or three sutures introduced below the crown stitch. In all cases demanding perineorrhaphy, a tear will have extended into or through the fascia which gives common attachment to the *sphincter vaginæ, transversi perinei* and *sphincter ani muscles.* The laxity of the vulvar outlet depends upon the extent of the tear into this tissue. The torn muscles or the fascia in the neighborhood of the muscles should be united with chromicized catgut before the more superficial stitches are passed. Chromicized catgut should be used in the vagina and silkworm-gut on the perineum. To prevent the sharp edges of the silkworm-gut from causing unnecessary suffering, the sutures should be left long with the ends tied together. They may be turned into the vagina and held by light gauze packing or a binding stitch.

After-treatment: Stitches should be removed in two weeks.

Complete Laceration. The preparatory treatment is the same as described in the operation for incomplete laceration.

Technic: The sphincter ani is grasped between the forefingers in the rectum and the thumbs externally, and stretched for about one minute. This will temporarily paralyze the muscle and prevent spasmodic contraction, which might interfere with the union of its ends. Furthermore, the relaxed muscle permits subsequent evacuation of the bowels with the

least strain on the recently united ends of the sphincter. Guide sutures are passed, as in the operation for incomplete tear, at the highest point of the rectocele and at the level of the lower carunculæ myrtiformes, and the entire area denuded in the manner described for incomplete perineorrhaphy.

If the laceration extend up into the recto-vaginal septum the margins are freshened and sutures of silk or fine chromicized catgut, inserted from the rectum, halfway through the septum on both sides and back again into the rectum, where they are knotted, the first suture being inserted at the apex of the tear. The ends of the sphincter muscle are then seized with tenacula and drawn out of the depressions in which they lie. Cicatricial tissue over the ends of the sphincter should be cut away sufficiently to expose the raw muscle, but not to shorten it. The ends of the sphincter should be united with chromicized catgut, the first suture including both ends of the muscle, a second suture being passed into the tissues in the neighborhood of the muscles and including the muscle sheath. The remainder of the operation is performed as for the incomplete perineal tear.

After-treatment: Stitches should be removed in eight to ten days.

NOTE.—As an additional precaution against carrying infection from the rectum into the wound, the stitches which unite the rectal mucosa may be introduced from the vaginal surface into the rectum, a separate needle being used for each right and left suture.

VESICO-VAGINAL FISTULA.

Technic: The perineum is retracted, the vaginal wall seized with small bullet forceps at four points opposite each other, a half-inch beyond the margins of the fistula. The tissues having been drawn taut, a superficial incision is made around the opening, one-quarter of an inch from the margin, to mark the limit of denudation. The tissues thus marked out are cut away with scissors down to, but not including the bladder mucosa. The cut surface should be beveled at the expense of the vaginal side.

When the fistula is situated near the neck of the bladder, care must be taken not to wound the ureters in denudation or include them in the stitches.

Sutures of chromic catgut or silk are then passed one-eighth of an inch from the denuded edge of the vaginal mucosa, down to the vesical mucous membrane where they emerge. They are re-introduced at the inner edge of the opposite denuded surface and passed through the septum opposite its point of entrance. Sutures are placed one-fifth of an inch apart. Before tying, the bladder is irrigated through the urethra to remove all clots. As the stitches are tied, the mucous membrane of the bladder is pushed inward so that a ridge is formed on its inner aspect. Pressure of fluid on each side of this elevation tends to hold the raw surfaces of bladder mucous membrane in coaptation. The wound should be closed in the long axis of the vagina if possible, to avoid shortening that canal. Tension may be relieved by dividing the vaginal mucosa longitudinally at the sides of the fistula, drawing the edges apart and approximating the angles with catgut sutures.

After-treatment: The patient should be catheterized

every two hours for the first two days—then every four hours for six days. Stitches removed in eight to ten days.

NOTE.—Firmer union is insured by uniting the denuded surfaces of bladder mucosa with buried sutures of fine catgut. These sutures should not pass through the mucous membrane into the bladder.

RECTO-VAGINAL FISTULA.

Previous preparation is the same as for operation for laceration of the perineum.

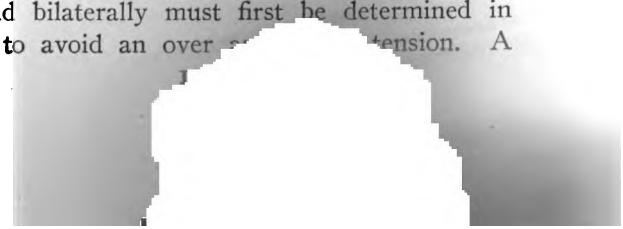
Technic: The sphincter ani muscle is paralyzed by stretching. The vagina cleaned and thoroughly dried, a strip of gauze with tape attached is packed in the rectum above the fistula, to prevent contamination of the operative field. Denudation and passage of sutures should be on the vaginal side and in accordance with the principles of the operation for vesico-vaginal fistula. The rectal tampon is removed after completion of the operation.

After-treatment: A tube should be left in the rectum to allow a free exit for gas. Stitches should be removed in eight to ten days.

NOTE.—A firm union may be better insured by uniting the raw edges of the rectal mucous membrane with buried sutures of fine catgut, before the vaginal sutures are passed.

ANTERIOR COLPORRHAPHY.

Method No. 1 (Stolz). *Technic:* As all points are to be brought to a common centre, the requisite amount of vaginal wall to be removed antero-posteriorly and bilaterally must first be determined in each case to avoid an over [illegible]ension. A



circle is then marked out with a scalpel at the most prominent part of the cystocele. This area is denuded of vaginal wall with curved scissors and mouse-tooth forceps. The bladder is separated by blunt dissection around the margin of the wound for about an inch. A purse-string suture of silk or chromic catgut is introduced. As the suture is drawn taut, the centre of the enclosed tissue is pushed up toward the bladder and the suture tied. If silk is used, it is removed in ten days.

Method No. 2. *Technic:* An incision is made through the cervical mucosa, another through the anterior vaginal wall, and the vaginal mucous membrane is dissected from the bladder in precisely the same manner as described in Anterior Vaginal Section (q. v.). The margins of the vaginal flaps are then trimmed away in a curved direction, the greatest amount of tissue being cut away at the most prominent part of the cystocele. Tissue should be sacrificed only to such an extent as will permit approximation of the edges without tension. In many cases the margins of the levator ani muscle can be brought together under the bladder and secured in the median line. They should always be sought for and united if possible, chromic catgut being used. The wound is closed by a row of longitudinal and one of transverse interrupted sutures as in Anterior Vaginal Section.

TRACHELORRHAPHY.

Technic: A weighted speculum is introduced into the vagina and the anterior and posterior lips of the cervix seized with bullet forceps in the median line. Long black silk loops may be used in place of bullet

forceps as tractors; they permit of easy manipulation and occupy less space. Retractors may be used on the sides to hold back the lateral walls and expose the angles of the tear.

The area of denudation is marked out with a scalpel, the line of incision passing beyond the angle of laceration externally, and in such a manner internally, as to leave about one-quarter of an inch of cervical mucosa down the middle of each everted lip, to allow for reconstruction of the cervical canal. The preliminary incisions will prevent removal of unnecessary tissue and aid clean-cut approximation of denuded surfaces. The area thus marked out is denuded with scissors to an extent which will permit the edges of the torn lips to come together without strain. If the tear is bilateral a similar denudation is made on the opposite side.

The first suture is introduced on the vaginal surface at the angle, coming out on the uterine surface of one lip at the margin of the cervical canal, having passed completely under the denuded surface, and reentering on the uterine surface, is brought out at a corresponding point on the opposite lip. The remaining sutures are introduced in the same manner. All should be introduced before being tied from above downwards. The suture material should be iron-dyed silkworm-gut, three on a side being usually sufficient. Fine superficial catgut sutures may be used between these to secure accurate union. Iron-dyed silkworm-gut is better because it is more readily seen on account of its color. Its tensile strength should be tested, as the dye may render it brittle. One end of the suture should be left long to facilitate removal. Sutures are removed in ten to fourteen days. Bleed-

ing is usually slight and controlled when the sutures are tied. If the circular artery is cut, the suture at the angle of laceration should be introduced at once and tied.

After-treatment: The vagina is lightly packed with gauze, which should be removed in twenty-four hours.

AMPUTATION OF THE CERVIX.

Low Amputation (Schroeder). *Indications:* (1) Great thickening and induration of the lacerated lips; (2) extensive cystic degeneration of the Nabothian follicles; (3) endocervicitis, with deep involvement of the glands; (4) stenosis in the lower portion of the cervical canal and os externum.

Technic: The anterior and posterior lips are widely separated by deep lateral incisions with the scissors. The diseased tissue is cut away on each lip, from the healthy tissue by a wedge-shaped section, the apex of which is directed toward the internal os. The vaginal margins of the wound are then stitched, both anteriorly and posteriorly, with chromicized catgut, to the margins of the intra-cervical mucous membrane. By this means the anterior and posterior lips of the cervix are folded upon themselves, and the vaginal mucous membrane is made to form the lining of the new cervical canal. The denuded lateral surfaces are sutured as in ordinary trachelorrhaphy.

High Amputation of the Cervix. Method No. 1. *Technic:* The anterior and posterior lips are grasped with bullet forceps, or preferably, two silk ligatures may be passed through the lips of the cervix and used as tractors. A circular incision is made at the

junction of the vaginal portion of the cervix with the vaginal vault.

Injury to the bladder is to be avoided by the occasional introduction of the sound, and by exerting all pressure against the cervix in stripping back the vaginal mucous membrane. If any cystocele is present the incision should be started as in Anterior Vaginal Section (q. v.) and the bladder pushed up out of the way before completing the circular incision through the vaginal wall.

The cervix is bared two to two and a half inches anteriorly and posteriorly. The separation will be found incomplete at the sides of the uterus where the uterine vessels enter.

Hemorrhage is largely controlled by passing a catgut ligature around these vessels high up on each side. They should be ligated close to the uterus to avoid including the ureters. The cervix is then split from the external os to the upper limit of denudation. After separating the lips, two or three chromicized catgut sutures are passed through the anterior vaginal wall, close to the cut margin, and made to emerge on the mucosa of the cervical canal one-quarter to one-half an inch below the upper angle of the split lips. Sutures are similarly passed through the posterior vaginal wall and lip.

The cervical lips are then amputated by strong, sharp scissors in such a way as to leave the tissue immediately around the canal the most prominent portion of the stump. The sutures previously passed are now tied, thus bringing the vaginal mucosa over the stump to the cervical mucosa. The edges of the vaginal wall on either side of the cervical canal are approximated with chromicized catgut, care being

taken to leave no pockets in which blood might accumulate.

Method No. 2. *Technic:* The cervix is split bilaterally with the scissors, up to the vaginal junction. The two flaps thus formed may be widely separated and permit of easy manipulation with the aid of silk tractors or bullet forceps. An incision is made on the vaginal aspect of the posterior flap, extending from the angle of the split on one side to that on the other, passing deeply into the cervical tissue in a direction to form an angle of about 45° with the cervical canal, but not extending quite to the cervical mucosa. The posterior lip is then removed by making an incision across the mucous membrane of the cervical canal, on the anterior aspect of the flap, to meet the former incision at right angles. The anterior lip is removed in a similar manner. Two chromicized catgut sutures are introduced on each flap to attach the mucous membrane of the vaginal portion of the cervix to the cervical. Two or three sutures are then passed on each side of the cervix to close the angles.

After-treatment: Same as after trachelorrhaphy.

Circular Amputation (Hegar). *Technic:* A circular incision is made at the junction of the cervical and vaginal portions of the vaginal mucous membrane. A cone-shaped excision on the cervix is made with the knife, the apex of the cone being toward the internal os. Two sutures of chromic catgut are inserted on each side of the cervical canal without emerging in it, running from before backward, thus bringing the mucous membrane of the vagina over the raw surface of the cervix on both sides of the canal. Two or three additional sutures are passed anteriorly and the same number posteriorly through

the wall of the cervix, uniting the vaginal and cervical mucous membranes. This modification of the original Hegar amputation, in which all sutures emerge in the cervical canal, permits of a neater coaptation.

VAGINAL SECTION (COLPOTOMY).

Anterior. *Technic:* The perineum is retracted, the cervix seized with bullet forceps and drawn downward. A transverse incision is then made on the anterior surface, three-fourths to one inch above the external os. The bladder is separated by blunt dissection, as far as the peritoneal fold, all pressure being directed against the uterus. As an additional precaution against injuring the bladder, should there be any cystocele present, the operation may be started by making an incision on each lateral aspect of the cervix three-fourths to one inch above the extremity. The mucous membrane is dissected up by using the handle of a scalpel which is worked toward the median line into the line of cleavage between the bladder and cervix. The instrument is then worked toward the external os until a stout resistance is met with; this is an utero-vesical ligament which is beyond the lower attachment of the bladder to the cervix. The lateral incisions are then united by a transverse incision which passes through the base of this ligament. This structure is cut and the further separation of the uterus and bladder proceeded with.

The edge of the cut mucous membrane is grasped on either side of its middle point by two small bullet forceps, upon which traction is made to put the anterior vaginal wall on the stretch. An incision is then made through the anterior vaginal wall at right

angles to the first, extending from its centre to one-half an inch below the urethra.

Next, the vaginal flaps are dissected from the bladder for a distance of one to one and a half inches on either side of this longitudinal incision (Goffe). The purpose of the second incision and the separation of the bladder is to gain additional space in which to work. The dissection should be done with the handle of the scalpel, counter-pressure being made with the finger. The hemorrhage is inconsiderable.

The peritoneal fold is opened close to the uterus by a blunt instrument or with the two index-fingers, and torn by lateral pressure.

After entering the peritoneal cavity, the uterus is drawn down by traction on the cervix, and the finger passed over the fundus and slipped along until it hooks over the broad ligament near the uterus. The cervix is now pushed downward and backward as the cornu of the uterus is dragged forward and downward. By this manœuver, after removal of the bullet forceps, the entire uterus may, in most cases, be delivered into the vagina. It is unnecessary to catch the fundus with bullet forceps or other pointed instrument. If desirable, a firmer grip may be secured by grasping the ovarian ligament near the uterus with sponge forceps. Having performed such intrapelvic operations as may have been indicated, the transverse incision in front of the cervix and the longitudinal incision along the vagina are united with interrupted chromicized catgut sutures. It is unnecessary to suture the peritoneum, as the torn margins fall together and readily unite.

Posterior. *Technic:* A perineal retractor is introduced, the cervix seized with bullet forceps and

drawn outward and upward. A transverse incision is made where a fold of mucous membrane will be seen to form opposite the cervico-vaginal junction. The tissues are separated up to the peritoneal fold by blunt dissection, the pressure being exerted against the posterior uterine wall, and in the median line. The peritoneal cavity is now entered as in the anterior section. It is common for some serum to escape when the cavity is entered.

In inserting the finger it is important to remember that the cavity has been entered below the plane of the bases of the broad ligaments and that manipulations are behind the broad ligaments upon their posterior surfaces. If desirable, an increase in space may be secured by making a cut through the centre of the posterior vaginal wall down to a point opposite the bottom of the *cul-de-sac*. After completion of such pelvic work as may have been indicated, the peritoneum is drawn out with bullet forceps and included in the sutures which close the incision in the vaginal wall. To meet indications, the incision may be left open or partially closed for drainage.

MEDIAN VERTICAL INCISION.

The initial incision is made two inches long, the lower limit extending to a point two finger-breadths above the symphysis pubis. When the incision is made through the linea alba, the recti muscles are not exposed or wounded.

If the linea alba has been displaced by any cause, it may properly be ignored and the cut made directly through the aponeurosis and upper fascial sheath of the rectus, the fibres of the muscle separated longi-

tudinally, and the structures beneath divided until the cavity is reached. In opening the cavity, the exposed peritoneum is caught superficially by two small dissecting or pressure forceps, the operator holding one, an assistant the other. The peritoneum is lifted and divided between the forceps by a single stroke of the scalpel. The peritoneum is usually sufficiently translucent to allow the viscera beneath to be seen as it glides over them. When such is not the case, the peritoneum lifted between the forceps should be seized between forefinger and thumb, free intestine will be felt to slip away, intestine that may have been grasped by the forceps may be recognized by the thickness of the tissue between the fingers and the fact that the peritoneum glides over the tissue underneath, excepting at points where it is held by the forceps.

The intestine may be adherent to the parietal peritoneum. In such cases the bowel is very liable to be cut unless the incision is made with great care. If there is reason to suspect the presence of adhesions, it is best to open the peritoneum above, below or to one side of the suspected point.

In a secondary operation, it is wise to assume the presence of adhesions along the line of the first incision.

The wound should be closed in layers. Plain catgut is used for the peritoneum, muscle and subcutaneous tissues; chromic catgut or kangaroo-tendon for the fascia; silk, silkworm-gut or catgut may be used for the skin.

TRANSVERSE INCISION.

Technic: A slightly curved transverse incision three or four inches long is made half an inch above the symphysis pubis, extending down to the aponeurosis of the external oblique, the concavity of incision being upward. Half of the wound should be on either side of the median line of the abdomen. The incised tissues are retracted upward and the aponeurosis and rectus fascia divided transversely three-quarters of an inch above the lowest point of incision. The fascia is adherent in the median line to underlying tissues and must be freed by sharp dissection above and below the transverse cut. It may be readily separated from the muscles on either side of the median line with the handle of a scalpel.

The fascia having been freed for two inches above and one inch below the incision, the rectus and pyramidalis muscles are bluntly separated and the properitoneal fat and peritoneum cut through in the same line. The peritoneal cavity should be opened at the upper limit of the wound and the opening enlarged from above downward, care being taken not to wound the bladder. The lower limit of the incision will open the prevesical space.

The peritoneum is closed with continuous catgut suture. The muscles readily fall together and are held in approximation with two or three interrupted catgut sutures. The edges of the fascia are accurately approximated with interrupted sutures of chromic catgut or kangaroo-tendon. The superficial fascia is united with a few fine catgut stitches and the skin closed by a sub-cuticular suture.

Advantages: Hernia is well-nigh impossible. The scar is small and becomes largely covered with pubic

hair. It permits wide exposure of uterine appendages. The appendix may be reached without difficulty.

Disadvantages: A little more time is required to enter abdomen than by median vertical incision. The limits of extension of the wound renders removal of large tumors impracticable.

BATTLE INCISION.

The Battle incision, sometimes called the Battle-Kammerer incision, is of use where both the appendix and other conditions in the right quadrant of the pelvis are to be treated, or where there is certainty of appendicular disease and a questionable pelvic condition.

Technic: A perpendicular incision three inches long is made, starting two inches below a line drawn from the umbilicus to the anterior superior spine of the ilium, and halfway between the outer and inner edges of the rectus. This would be on a line with the spine of the pubis.

The sheath of the rectus is then divided to correspond to the skin incision. The rectus is not cut but pushed to one side, the attachment of the outer edge to its sheath being carefully dissected away. The operator may select the centre of the lower section of rectus muscle and bluntly push in both directions toward the ends of this section, stretching rather than severing the tissue, which is found at each extremity to be attached to the edge of the muscle. Trophic nerves enter the rectus muscle at its under surface near the edge and pierce the muscle at the upper and lower ends of each section. Injury to these nerves will affect the future nutrition of the muscle and will weaken the wall just where it is intended to

prevent hernia. The muscle is lifted up and an incision made in the peritoneum in the line of the skin incision. The peritoneum is held with loop-retractors of silk or catgut on either side.

Care must be taken not to injure the deep epigastric vein. The artery usually slips away from the operating field without difficulty, but if roughness be employed in separating one of the veins passing along with the deep epigastric there will be considerable bleeding, and, if not detected, a hematoma will form.

INTRA-PERITONEAL SHORTENING OF ROUND LIGAMENTS.

Technic: The abdomen is opened by one of the usual incisions, and the uterus brought forward. The round ligaments may then be shortened by one of the following methods:

(1). Each ligament may be folded once on itself an inch or two from the uterus and the folds sewn together in front of the broad ligament. (WYLIE.)

(2). The ligaments may be shortened as in the Wylie method and the folds sewn to the fundus of the uterus. (GOFFE.)

(3). The ligaments may be looped twice on themselves and the three folds sewn together. (MANN.)

(4). A loop of each round ligament may be carried through the broad ligament and united to its fellow of the opposite side behind the uterus. (WEBSTER-BALDY.)

(5). REED folds the ligaments once on themselves but directs the loop inward and backward.

ROUND LIGAMENT VENTRO-SUSPENSION OF UTERUS.

Gilliam Operation. *Technic:* The usual median vertical incision is made. The uterus is brought forward and the broad ligament of one side seized between the finger and thumb, or with bullet forceps, and brought into the wound. The round ligament is picked up and a ligature passed beneath it, including a portion of the broad ligament tissue, at a point one and a half inches from the uterus. The ends of the ligature are brought out of the wound and secured in the bite of an artery clamp. The other round ligament is secured in the same manner.

At a point one and a half inches above the pubes, the peritoneum, muscle and external oblique aponeurosis at one edge of the wound are pinned by a vulsella, care being taken that the edges of these layers are in line. The skin and superficial fat are pushed in the opposite direction, uncovering the aponeurosis. With a narrow-bladed knife, or with specially devised forceps, an opening is made from the surface of the aponeurosis into the peritoneal cavity, one-half inch from the edge of the abdominal incision, passing obliquely downward, outward and backward, emerging on the peritoneum one inch from the margin of the wound. The ligature which loops the round ligament is now brought through this opening from within outward with a pair of forceps, and a loop of round ligament one-fourth or one-third of an inch long is drawn above the surface of the fascia. This loop is secured to the aponeurosis by three catgut sutures. The loop of round ligament is deflected outward, the first suture anchoring its apex to the aponeurosis, the second

passing half way between apex and base of loop and tied at inner side, and the third passing through the loop at its base and tied at outer side. The traction ligature first passed around the ligament is withdrawn, the opposite side dealt with in a similar manner, and the abdominal incision closed.

Advantages: After both ligaments have been fastened, an opening of from seven to nine inches in circumference will exist between the uterus and the abdominal wall, thus avoiding the possibility of intestinal strangulation. The uterus is not fixed, but is enabled to conform to the altered condition of the bladder and rectum, and to the various body movements. There is no embarrassment in gestation or difficulty in parturition.

After-treatment: Same as for any laparotomy. The bladder should be emptied at frequent intervals, as described in the Alexander operation, q.v.

Ferguson-Gilliam Operation. *Technic:* The abdomen having been opened the aponeurosis of the external oblique is separated from the fascia over the rectus and retracted. A blunt-pointed pair of forceps is passed through the rectus muscle beneath the aponeurosis into the peritoneal cavity. The puncture is made one inch above the lower angle of the incision three-quarters to one inch from the margin, and extends downward, outward and backward. A loop of the round ligament is pulled through the rectus muscle after the manner described in the Gilliam operation (q.v.).

The peritoneum is closed and the muscles approximated with catgut. Each loop of round ligament is then stitched to its fellow on the opposite side. The

approximated loops are included in the suture which unites the margins of the aponeurosis of the external oblique. The skin and subcutaneous tissues are united in the usual manner.

The Richelot-Doléris Operation. *Technic:* The abdomen is opened, the round ligaments picked up with bullet forceps and approximated in the lower angle of the wound while held by an assistant, a needle threaded with chromic catgut or silk is introduced through the peritoneum on its under surface one-quarter of an inch from the margin of the incision and one inch above the lower angle, and carried half an inch away from the median line. As the suture emerges from the peritoneum it is passed through the upper third of each round ligament and re-introduced into peritoneum and muscle in order reversed to its entrance. The first suture is passed through the ligaments one inch distal to their uterine junction, a second suture is passed half an inch below this. The stitches are introduced as in the Kelly operation for ventral suspension, but carried through the round ligaments instead of through the uterus. The abdominal wound is closed in the usual manner after the suspension sutures have been tied.

OVARIAN SUSPENSION (Barrows).

Technic: The abdomen is opened through a median vertical, Battle or transverse incision, two inches in length. The uterus is brought forward into the wound and the round ligament shortened, if necessary, by one of the methods previously described. If the broad ligament is much relaxed each infundibulopelvic ligament is shortened one to two inches by

being folded upon itself and sutured with chromic catgut. The fold should be made in the upper part of the ligament to avoid inclusion of the ovarian artery which enters its base.

An incision one-half to three-quarters of an inch long is made in the broad ligament parallel to and a half inch below the tube, ending at a point half an inch from the uterus. The ovary is brought through this incision and placed on the triangular shelf formed by the broad ligament between the tube and the round ligament and fixed in position by a catgut suture at each extremity. An additional suture may be placed above and below. Care should be taken not to twist the ovary on its pedicle, thereby causing a constriction of the vessels.

NOTE.—There is no constriction of the ovary and no interference with the relation between ovary and tube.

The wound is closed in the usual manner.

VENTRAL SUSPENSION OF THE UTERUS (Kelly).

Technic: A median incision is made through the abdominal wall, two inches in length, extending upward from a point two finger breadths above the symphysis pubis. The peritoneum and pro-peritoneal tissues are transfixed with a needle threaded with chromicized catgut or silk, at a point near the lower angle of the wound and one-quarter of an inch from the cut edge. The needle is passed on the under surface of the peritoneum, directed away from the median line and includes one-half to three-quarters of an inch of tissue.

The uterus is brought forward and the fundus

transfixed by the same needle, carried transversely through three-quarters to one inch of uterine tissue, one-quarter of an inch deep, at the level of the attachment of the Fallopian tubes. The suture is then passed through peritoneum and pro-peritoneal tissue of the opposite side at corresponding points but in reversed order to the first introduction of the needle, i. e., the stitch is passed toward the median line instead of away from it.

A second suture is then inserted in a similar manner, passing through the peritoneum half an inch above the first suture and through the uterine tissue on the posterior wall one-half inch below the insertion of the tubes. After the introduction of the finger to make sure that the intestines are free, the sutures are tied. The omentum is then drawn down and the peritoneum closed with a continuous suture. The abdominal wound is closed in the usual manner.

After-treatment: The bladder should be emptied at frequent intervals, as in ventral fixation (q.v.) in addition to the usual care after abdominal section.

VENTRAL PSEUDO-FIXATION OF UTERUS FOR PROLAPSE (Ashton).

The object of this operation is to make a firm union between the anterior abdominal wall and the fundus of the uterus. It should never be done, except in women who have passed the menopause, without first rendering the patient sterile.

Technic: The usual median vertical incision is made and the uterus drawn into the wound. A space on the fundus one inch long and half an inch wide is denuded of peritoneum. Two silkworm-gut sutures are passed one-quarter of an inch deep under the de-

nuded area from one side to the other. A strip of parietal peritoneum, half the size of the raw surface on the fundus, is removed with scissors on each side of the abdominal incision near its lower angle. The ends of the fixation sutures are passed completely through the abdominal wall so that when they are tied, after the abdominal wound has been closed, the denuded uterine and abdominal areas will be in contact.

After-treatment: In addition to the usual care following abdominal section, the bladder should be emptied at intervals of four, five, six, seven and eight hours respectively for the first five days. All sutures are removed after eight or ten days.

NOTE.—By the term "ventral fixation" is meant the retention of the uterus in immediate relation to the abdominal wall by means of permanent suture material, the area of the uterus and the corresponding area of the abdominal wall having been denuded of peritoneum.

By the term "ventral pseudo-fixation" is meant the retaining of the uterus in contact with the abdominal wall by non-absorbable stitches which are subsequently removed, the approximating surfaces having likewise been denuded.

By "ventral suspension" is meant the placing of the uterus in contact with the abdominal wall by the employment of absorbable suture material or silk (Kelly) without denudation of the surfaces in contact.

OTHER METHODS OF CORRECTING RETRO-DISPLACEMENTS OF THE UTERUS.

(1). **The round ligaments** may be cut at the internal abdominal rings, dissected out of the broad ligaments and fastened in the abdominal wound or carried through the rectus muscle and fascia, and fastened above the latter.

(2). An oval denudation may be made on the anterior uterine wall; an area on each broad ligament is then denuded just below the round ligament, beginning an inch or more from the uterus and corresponding in size to the denuded area on the uterus. The inner half of each denuded portion of the broad ligament is sutured to a corresponding half of the denuded area on the uterus. The outer halves of the denuded surfaces on the broad ligament are sutured to each other. (A. P. DUDLEY.)

(3). A portion of the urachus may be stripped toward the bladder, the free end button-holed through the fundus of the uterus and secured to the abdominal wall. (FOWLER.)

RESECTION OF THE FALLOPIAN TUBE

Many cases of tubal diseases occur in which the sacrifice of the entire tube is unnecessary. Even though but a small portion near the cornu be uninvolved, provided some ovarian tissue remains on the same side, it should be saved.

Technic: The diseased portion of the tube having been removed, a small grooved-director is introduced into the abdominal opening of the remaining portion of the tube and the tube so incised latterly as to make a superior and an inferior flap. The

ovary or portion of ovary remaining is then sutured between the flaps. The stitches of the catgut are so arranged that the tubal mucosa and serosa are united and at the same time the tip of each flap is secured to the ovarian tissue. Pregnancy has occurred as a result of this procedure.

SALPINGECTOMY.

Technic: The abdomen is opened through the median vertical, transverse or Battle incision. The ovarian artery is ligated close to the uterus by passing a catgut ligature around a half inch of broad ligament tissue, just below the tube. Several ligatures are then passed in series from just below the fimbriated extremity of the tube toward the uterus. The tube is removed with scissors, from the broad ligament close to its attachment. The uterine portion of the tube is removed by taking a wedge of tissue from the uterine cornu (vid. salpingo-oöphorectomy). The uterine wound is closed with interrupted sutures and the cut margin of the broad ligament sutured by a running catgut suture. The abdominal wound is closed in the usual manner.

SALPINGO-OÖPHORECTOMY.

Technic: The abdomen is opened through the median, transverse or Battle incision. A ligature is placed around the infundibulo-pelvic ligament including the ovarian artery. A second ligature is passed through a half inch of the broad ligament close to the uterus, just below but not including the tube. These ligatures shut off most of the blood supply of the tubes and ovaries and render the remainder of the operation practically bloodless.

The tube, ovary and adjacent portion of the broad

ligament are lifted and removed with scissors. Temporary clamping is usually sufficient to secure all bleeding points. The uterine extremity of the tube should be removed by taking a deep wedge of tissue from the cornu, otherwise physiological and pathological processes may continue after operation. The uterine wound is closed and the raw edge of the broad ligament turned in and secured with catgut sutures.

VAGINAL HYSTERECTOMY.

Hemostasis by Ligature. *Technic:* A weighted speculum is introduced and the cervix exposed. Any diseased tissue around the external os should be cauterized with pure carbolic acid or the actual cautery. The os uteri should be closed with strong silk sutures, the ends of which may be left long and utilized as tractors. The uterus may be exposed after the manner described in anterior and posterior vaginal sections, or a circular incision may be made around the cervix, at a safe distance from any diseased tissue, and the loose tissues and bladder stripped back to the peritoneal fold. The peritoneum is opened in front and behind the uterus and torn latterly to the region of the broad ligaments.

The uterine arteries enter the uterus in the base of the broad ligaments at about the level of the internal os. These vessels are next ligated *close* to the uterus to avoid injury to the ureters which pass behind and below the uterine arteries three-fifths of an inch to the outer side of the uterus at the level of the internal os.

The bases of the broad ligaments are cut away from the uterus to the upper limit of the ligated tissues, the uterus drawn further down and a second

ligature applied above the first. The broad ligaments are again divided. The uterus is then ante-verted (vid. *anterior vaginal section*) and the upper portion of the broad ligament is ligated on each side and cut away from the uterus. If the uterus is large, its removal may be facilitated by dividing it into halves, each half being drawn through the vagina separately and removed. The stumps of the broad ligaments are drawn down in the vaginal wound by the ends of the ligatures, which have been left long, and their cut edges united with catgut.

The vaginal wound is then closed, the stitches including the broad ligament stumps in their grasp. The fixation of the ends of the broad ligaments between the peritoneal and vaginal sides of the wound serves to prevent prolapse of bladder, vagina and rectum. If the ends of the ligaments will not reach the vagina, the ligatures are cut short, and the stumps returned to the pelvic cavity. The vaginal wound is closed with or without a drain, as conditions may require. The vagina is loosely packed with gauze.

After-treatment: The vaginal packing is removed in twenty-four hours.

Hemostasis by Forcipressure. The *technic* is in general the same as in the ligature operation, except that clamps are used in place of ligatures. Having opened into the peritoneal cavity in front and behind the uterus, a gauze pad with a ligature attached is placed in the *cul-de-sac* of Douglas to protect the intestines and absorb the blood. The base of the broad ligament is then seized between the first and middle fingers and the neighboring tissue crowded toward the pelvic wall in order to displace the

ureters laterally. A broad ligament clamp is next applied between the fingers and the uterus at a sufficient distance from that organ to prevent the instrument from slipping off after division of the ligament. The procedure is repeated on the opposite side and the broad ligaments divided as far as the tips of the clamps.

The fundus uteri is then delivered into the vagina (vid. *anterior vaginal section*) together with the appendages of one side. The bladder and anterior vaginal wall are supported with a flat-bladed speculum, the tube and ovary raised between the thumb and index-finger, beneath which a clamp is applied from above downward to the tip of the clamp controlling the uterine artery. The ligament is divided distal to the clamp and the uterus delivered. The opposite broad ligament is then clamped and divided in the same manner. The handles of the forceps should be securely tied together to prevent them from snapping apart. The gauze pad in the *cul-de-sac* is removed.

When practicable the broad ligament stumps should be drawn into the vagina and sutured with catgut. By this means all wounded tissue except the peritoneum is excluded from the peritoneal cavity and fairly substantial support is given to the pelvic floor. Strip gauze should be packed into the pelvis as high as the tips of the clamps, to prevent prolapse of intestines or omentum, and the vagina lightly packed with gauze. The handles of the forceps should be supported by a bandage and surrounding tissue protected with small gauze pads.

After-treatment: In general the care is the same as for an abdominal section. The clamps and gauze packing should be removed in forty-eight hours.

Advantages of the Forceps Operation. (1) It may be rapidly performed; (2) it does not necessitate profound narcosis; (3) drainage is facilitated by the continuity of surface of the clamp; (4) danger from secondary hemorrhage is *nil* when the clamps are properly applied.

Disadvantages. (1) The forceps cause severe pain; (2) their removal is painful.

ABDOMINAL HYSTERECTOMY.

1. **Supra-vaginal.** *Technic.* The usual median abdominal incision is made. In case of a large tumor the incision should be made high up to avoid the bladder, which may be drawn up by the growth. A ligature of stout catgut is passed around the infundibulo-pelvic ligament and tied just below the fimbriated extremity of the tube. This shuts off the ovarian artery as it passes inward between the layers of the broad ligament. A second ligature is passed around the uterine end of the tube, including half an inch of tissue underneath. This prevents reflex hemorrhage from the tubo-ovarian anastomosis.

Ligatures are similarly placed in the broad ligament of the opposite side. The broad ligaments are divided with scissors to a point close to the uterus just above the level of the internal os, commencing immediately below the fimbriated extremity of the tube. The round ligaments should be ligated before division. The peritoneum around the uterus is divided with a scalpel just above the bladder attachment. (Insert sound in bladder if in doubt.) The circumuterine peritoneum is stripped down with a gauze sponge. The uterine arteries are tied close to the uterus with catgut, remembering that the ureters pass under the uterine

arteries three-fifths of an inch to the outer side of the uterus at the level of the internal os.

The body of the uterus is severed from the cervical portion by a wedge-shaped incision directed antero-posteriorly (Dudley). Bleeding points are ligated. The canal of the cervical stump is closed by a suture and covered by peritoneum. The cut margins of the broad ligaments are attached below to cervical stump and to each other by an end-to-end approximation and secured by a continuous catgut suture. If the broad ligaments are too short for complete end-to-end approximation this method of union is carried only to a point where tension is reached and closure of the remainder of the ligament accomplished by a line of union running from side to side. If drainage is required, it is best accomplished through an opening in the *cul-de-sac.* The abdominal wound is closed in the usual manner.

NOTE.—When unnecessary to sacrifice the ovaries the ligature around ovarian artery in the infundibulo-pelvic ligament is omitted, the vessel being cut between two ligatures near the uterus. The tubes are removed from the broad ligament as described in salpingectomy (q.v.), but are left attached to the uterus.

Advantages: This method of uniting broad ligaments prevents their retraction to the sides of the pelvis and enables them to give support to the bladder, vagina and rectum.

After-treatment: The usual treatment after laparotomy.

2. **Complete Hysterectomy.** *Technic:* The operation is substantially the same as for supra-vaginal

hysterectomy; the cervix, however, is not amputated. The bladder is stripped from the cervix by gauze pressure, and the peritoneum of the posterior wall of the uterus dissected off in the same way. The cervix is cut from the vagina at the utero-vaginal attachment and the uterus removed. If drainage is not required, the vaginal wound is closed. The upper end of the vagina should be included in the stitches uniting the bases of the broad ligaments, which structures should be approximated in the manner already described.

If in doubt as to the point of utero-vaginal junction, the cervical canal may be split open with sharp-pointed scissors, the cut extending through the external os. The junction of the vagina with the cervix may then be readily determined by insertion of the finger into the vagina through the opening thus made.

NOTE.—The operation of *Pryor* for extensive carcinoma calls for the following procedure: The ovarian vessels are ligated close to the pelvic brim, the broad ligaments cut close to the ligatures down to their lateral attachments and the round ligaments ligated and cut close to the internal rings.

An incision is made from side to side through the peritoneum at the level of the utero-vesical fold, the lower portion is pushed down with the finger and each internal iliac artery found by blunt dissection and ligated. The ureters are dissected free of surrounding tissue from their insertion into the bladder to a point above the iliac vessels. The uterine arteries are ligated close to their origins from the internal iliacs as an additional precaution. The uterus and appendages, including the broad ligaments, are removed. All fat in the obturator foramina, about the

upper third of the vagina and between the iliac vessels, and all visible glands are removed. Particular attention should be paid to the removal of all glands and lymphatics at the bases of the broad ligaments.

FEMORAL HERNIA.

Anatomy: The protrusion in femoral hernia takes place through the crural canal, which is enclosed in the crural sheath together with the femoral artery and vein. The artery passes beneath Poupart's ligament at a point midway between the spine of the pubis and the anterior-superior spine of the ilium. The vein lies one finger's breadth to the inner side of the artery; the crural canal a finger's breadth to the inner side of the vein. The anterior crural nerve is not involved in the hernia, being situated to the outer side of the femoral artery.

The crural canal is the narrow interval between the femoral vein and the inner wall of the crural sheath. It exists as a canal only when the sheath has been separated from the vein by dissection or by the pressure of a hernia or tumor. It is one-quarter to one-half an inch in length and extends from Gimbernat's ligament to the upper part of the saphenous opening. The canal has two orifices, the upper is the *femoral* or *crural ring,* covered by the *septum crurale;* the lower one is the saphenous opening, covered by the *cribriform fascia.*

The two common points of constriction in strangulated femoral hernia are at Gimbernat's ligament and at the falciform process of the saphenous opening.

In relieving strangulation at the femoral ring the following points should be borne in mind: Incision *externally,* injury to vein; *superiorly,* involves integrity

of Poupart's ligament; *backward,* of no service, because of impingement upon bone; ***internally,*** danger of injury to obturator artery.

In about one case in four the obturator artery arises from the deep epigastric instead of from the internal iliac. In about one-half the cases in which this occurs the obturator curves along the inner margin of Gimbernat's ligament, and would thus circle the inner boundary of the ring. To avoid injury to important structures, constriction at the neck of the sac should be relieved by repeatedly nicking the edge of Gimbernat's ligament downward and inward at the attachment of the ligament to the bone. The tip of the left index finger should be introduced into the femoral ring to act as a guide. The nicking may be done by the tip of the knife or with scissors.

The operation for femoral hernia may be performed in one of the following ways:

Bassini Operation. *Technic:* The incision is made at an angle of about ten degrees with Poupart's ligament, the object being to make a cut which would render it easy to do either a femoral or an inguinal hernia operation, or both, through the same opening. The lymph glands and fat over the saphenous opening are removed. The sac is exposed, opened, and the hernia reduced.

Care must be taken not to injure the internal saphenous vein which crosses over the lower margin of the saphenous opening to join the femoral.

The sac is twisted in its long axis to prevent any protrusion of the abdominal contents. The neck is transfixed with a double thread of chromic catgut, each half tied, and the ends left long. The sac is cut off close to the ligature. The ends of the ligature are

now threaded on a small round needle and each end carried from underneath Poupart's ligament, out through the aponeurosis of the external oblique in such a way as to pull the neck of the sac inward and upward away from the point of exit of the hernia. The two ends are brought through the aponeurosis within half an inch of each other and tied.

Three or four sutures should be introduced uniting the pectineal fascia and muscle and the pubic portion of the fascia lata to the iliac portion of the fascia lata at the outer margin of the saphenous opening. The uppermost stitch should be carried well up inside the ring to include all the structures below and close to the ilio-pectineal line.

The second stitch should be introduced from above downward through Poupart's ligament, passed through pectineal fascia and the margin of the falciform process and out through Poupart's ligament.

Care must be taken not to constrict the vein. The skin wound is closed in the usual manner.

Cushing. *Technic:* A purse-string suture is passed in the margin of the saphenous opening, the free ends emerging on the upper surface of Poupart's ligament, where they are tied.

Cheyne-Burghard. *Technic:* The fascia over the pectineus is dissected clear. A U-shaped musculo-fascial flap with its base toward Poupart's ligament, and of sufficient size to fill the hernial opening without tension, is then marked out. The greater part of the thickness of the muscle is included in the flap, which is peeled back with the handle of a knife. The pedicle is left sufficiently long to allow the flap to be pulled well up into the crural canal.

At the lowest angle of the flap two stitches are

passed, emerging on the raw surface, the ends of each being left long. The free ends are re-threaded on a curved needle and carried up into the crural canal and through the aponeurosis of the external oblique above and to its outer side. The flap is dragged into the upper end of the crural canal by pulling upon these stitches, thus causing the cut section of pectineus muscle and fascia to turn on itself and bring the raw surface in contact with the abdominal wall.

The stitches are tied and the operation completed by inserting two or three stitches between the margin of the saphenous opening and the muscular fibres and fascia of the pectineus.

INGUINAL HERNIA.

This may be indirect (oblique) or direct. The former enters at the internal abdominal ring, passes downward, forward and inward in the inguinal canal through the external ring. In the direct variety the protrusion takes place through the abdominal wall to the pubic side of the deep epigastric artery. The hernia is termed complete when the protrusion has passed through the external ring.

Bassini Operation. *Technic:* An incision two or three inches long is made over the inguinal canal (vid. Alexander operation), exposing the aponeurosis of the external oblique. The margins of the wound are retracted and the aponeurosis divided for two or three inches along the line of incision. The borders of the opening thus made are drawn aside by traction sutures and the hernial sac raised *en masse* from the inguinal canal. The sac is separated from surrounding structures, opened at its most dependent part, contents examined and returned to the peritoneal cavity.

The neck of the sac is transfixed and tied in halves with strong catgut and cut off. The conjoined tendon and fibres of the internal oblique are secured to Poupart's ligament beneath the lower aponeurotic flap of the external oblique with interrupted chromic catgut sutures. The aponeurosis is closed in a like manner. The superficial fascia and fat are approximated with a few plain catgut sutures and the skin wound closed by the intracuticular or other method of suture.

The round ligament may be included in the suture which unites the conjoined tendon and internal oblique to Poupart's ligament, care being taken not to include the ilio-inguinal and the genital branch of the genito-crural nerves.

In the case of *strangulation,* the constriction is either at the internal or external ring, rarely in the inguinal canal. If at the internal ring it should be divided upward and outward to avoid the deep epigastric artery, if at the external ring the constriction may be nicked in any direction.

Kocher Operation. *Technic:* The aponeurosis of the external oblique is exposed. A transverse incision is made through the aponeurosis over the internal ring large enough to permit the withdrawal of the sac, the contents having previously been reduced. A pair of dressing forceps is passed through this incision, the tip of the sac is grasped and withdrawn, the sac opened, reduction of contents completed, and the neck transfixed by sutures which secure it to the edges of the incision in the aponeurosis of the external oblique. The sac is then drawn downward on the aponeurosis over the inguinal canal and sutured in place, the stitches passing deep into the

aponeurosis on either side of the sac, so as to form a strong pad over the weakened portion of the abdominal wall. The superficial wound is closed as in the Bassini operation.

UMBILICAL HERNIA.

Method No. 1. *Technic:* An incision including the umbilicus is made encircling the hernial protrusion, the elements reduced, and the sac ligated by being transfixed and tied in halves. The peritoneum is closed with a continuous stitch. The remainder of the abdominal wall is closed by alternating a through-and-through silkworm-gut suture with a figure-of-eight suture.

The latter, sometimes called the Fowler-Mayo stitch, causes an overlapping of the edges of the aponeurosis and is introduced in the following manner after freeing the aponeurosis from the rectus and the muscle from the peritoneum on each side: The stitch is passed through the skin, one-half to three-quarters of an inch from the edge of the skin wound, down to the aponeurosis of the external oblique, carried to the opposite side, going through the edge of the external oblique aponeurosis and rectus muscle, from the pro-peritoneal space outward, again passing across the wound to the side where the stitch was first introduced, passed through, from without inward, the external oblique aponeurosis and rectus muscle, an inch from the edge of the wound; again traversing from one side of the incision to the opposite side and going through all the structures of the abdominal wall from within outward, an inch from the edge of the incision. Thus, when the stitch is drawn taut, the edge of the aponeurosis of one side

overlaps the edge of the other to the extent of three-quarters to one inch. All stitches except the peritoneal remain untied until the suturing is complete. Interrupted or continuous sutures are placed in the skin.

This method of suturing is advantageous for small umbilical herniæ or for large abdominal wounds when it is necessary to get the patient out of bed quickly.

The objection to this method is its increased technic and greater difficulty in removing the stitches. The latter can be avoided by depressing the skin at one puncture point and cutting the suture deep in the tissue. This will allow the internal cut end to spring away underneath, unlocking the figure-of-eight.

Method No. 2 (Blake). *Technic:* A large elliptical skin incision is made, removing the subcutaneous fat, with exposure of a considerable portion of the aponeurosis of the external oblique, sac and peritoneum being treated in the usual manner. The linea alba is divided to the upper and lower limits of the skin incision, the peritoneum is separated from the abdominal wall on one side, and the musculo-aponeurotic flap, freed from peritoneum, is drawn over the opposite rectus muscle and secured by two rows of chromicized catgut stitches, the first uniting the free border of the over-lapping flap to the over-lapping wall by through-and-through sutures; the second uniting the free border of the superficial flap to the deep wall by sutures which do not enter the abdominal cavity. The cutaneous wound is closed in the usual manner.

APPENDECTOMY.

Gridiron Incision. This method is best adapted to interval cases and those in which the diseased area is of limited extent.

Technic: The primary incision, extending down to the aponeurosis of the external oblique, is made at right angles to an imaginary line extending from the anterior superior spine of the ilium to the umbilicus, at the juncture of the outer third with the inner two-thirds. The incision should be one and a half to two and a half inches long, one-third being above and two-thirds below this line.

The aponeurosis of the external oblique is divided in the line of its fibres and the fibres of the external oblique and transversalis muscles are bluntly separated in their respective directions, after the intermuscular planes of faciæ have been divided. The transversalis fascia and peritoneum are divided in the plane of the fibres of the transversalis muscle.

When the peritoneum is held up between two pairs of forceps, preparatory to opening into the abdominal cavity, if the finger and thumb of operator's right hand be brought against that part of the peritoneum held between the forceps, and pressure be brought to bear, non-adherent intestine or omentum may be felt slipping away. If this is not felt it is best to take another grasp of tissue and make a like attempt to elicit the sensation, in order to establish the presence or absence of adhesions. Retractors of silk or catgut are used for the peritoneum, a loop being introduced from the pro-peritoneal side through the peritoneum a short distance from the edge. Such retraction stitches are out of the way and no space is encroached upon.

To Find Appendix: First introduce the forefinger into the abdominal cavity, sweep it around the peritoneal opening, noting the presence or absence of adhesions. Ascertain whether there is an abscess present. Pass the finger toward the right anterior iliac spine into the hollow of the iliac fossa. While hugging the pelvic wall, the finger is passed toward the umbilicus until it meets the first attached portion of the intestine. This part of the bowel is lifted into the wound between the thumb and forefinger.

The large intestine may be recognized by the longitudinal bands (*tenia coli*), the pouches (*valvula sigmoidia*), and the pouches containing fat (*appendices epiploicæ*). The longitudinal bands arise at the base of the appendix, which organ may be located by tracing a band downward.

If adherent, the appendix should be cautiously separated from its connections. The meso-appendix should be tied with several successive ligatures of catgut, then divided with scissors and the appendix, isolated with gauze pads, lifted into the wound. Manipulation of the appendix may be facilitated by securing the tip with a ligature or a clamp. The appendix may be removed and the stump treated in one of the following ways:

(1) A purse-string No. 1 chromic catgut suture is passed around the base of the appendix, going through the superficial tissues of the cecum, and the ends left untied. The appendix is then cut off with scissors or cautery half an inch from its base, the lumen stretched with fine forceps and the stretched tissues invaginated into the cecum with thumb-forceps, and held there while the suture is tied. The invagination may be reinforced by two or three interrupted catgut sutures.

(2) A purse-string suture is passed through the peritoneal coat of the appendix about one-quarter of an inch from the base. A circular incision is made through the serous coat one-quarter of an inch above the suture. The peritoneum is then stripped back just beyond the base with a piece of gauze. The appendix is amputated at its base with a cautery, and the small cautery needle introduced into the lumen of the remaining portion of the appendix and the mucous membrane thoroughly cauterized; or the stump may be squeezed in a clamp and ligated.

The opening in the bowel is now closed by inverting the edges of the stump with forceps as the purse-string suture is tied. Subsequently a chromicized catgut stitch is introduced into the ends of the longitudinal muscular bands, encircling the line of sutures already introduced. The sutures used to ligate the meso-appendix, having been left long, one or more of these are tied to the catgut holding the base of the longitudinal muscles. All raw surface on the meso-appendix is turned in, or sutured over the end of the caput coli.

Thus not only is the stump of the appendix securely closed and all raw surfaces treated so as to prevent adhesions, but in addition the important function of the longitudinal bands of the large intestine is not interfered with, as these muscles are again given a strong point of origin and not left without proper support, as is so often done. Some, at least, of the troublesome bowel symptoms following in the train of appendicular operations may thus, in large measure, be prevented. The abdominal wound is closed in layers.

After-treatment: The usual care after laparotomy.

NOTE.—In the gridiron incision the small nerve lying between the transversalis and internal oblique should be drawn to one side and not divided. The fascia covering the muscular layers should be cut so as to avoid tearing the muscular fibres when separating them.

COCCYGECTOMY.

Technic: The patient is placed in Sims position. An incision is made obliquely from the base of the coccyx across the raphe to a point one-quarter of an inch from the tip on the opposite side. The oblique incision is to be preferred because the tissue immediately in the raphe is poorly nourished. The wound is not carried to the tip of the coccyx, thus avoiding severing the tissues giving support to the sphincter ani. The tissues are retracted and all structures cut loose from the bone with heavy scissors. By working around the bone with the handle of a scalpel the anterior and lateral aspects of the coccyx are freed from adherent tissue.

The bone is then divided at the sacro-coccygeal joint with bone forceps, a Gigli or a chain saw. The alæ of the first coccygeal bone are the best means of determining when the base of the coccyx is reached. The severed bone is raised from below upward to avoid forcing the sharp tip into the rectum. Injury to the *sacra media* artery, which lies directly anterior to the coccyx, should be avoided by carefully working around the bone with a blunt instrument. Luschka's gland is of no importance. The bottom of the wound should be closed with buried catgut sutures, care being taken to leave no pockets for blood accumulations. The more superficial part of the wound is closed with catgut or silk.

EXPLORATION OF ABDOMINAL WALL AND VISCERA.

Abdominal Wall. The *linea alba* is formed by the interlacing fibres of the aponeuroses of the internal and external obliqui and transversales in the median line. It extends from the ensiform cartilage to the symphysis, and is broad above and narrow below.

The *lineæ semilunares* are curved tendinous lines at the outer border of the rectus muscles. Each linea is formed by the apposition of the internal oblique at its point of deviation to enclose the rectus, where it is reinforced by the aponeuroses of the external oblique in front and the transversalis behind, and extends from the tip of the ninth costal cartilage to the spine of the pubis. At the commencement of the lower quarter of the rectus muscle the posterior lamina of the sheath terminates in a thin curved margin, the *semi-lunar fold of Douglas.* Below this fold all muscle aponeuroses pass in front of the rectus.

If an incision extends from a little below the umbilicus to a point two finger breadths above the symphysis pubes in the median line, the following structures are severed: Skin, subcutaneous fat, deep fascia, linea alba, pro-peritoneal fat and peritoneum. If the incision passes a little to one side of the median line it passes through skin, fat, deep fascia, anterior layer of rectus fascia, rectus muscle, posterior layer of rectus fascia, pro-peritoneal tissue and peritoneum.

The *lineæ transversæ* are three transverse lines which intersect the recti, connecting the *linea alba* with the *lineæ semilunares.*

If the median incision pass above the umbilicus this depression should be excised, or the incision should

pass to the left of it to avoid the round ligament of the liver.

A superficial epigastric artery may be cut beneath the fat two finger breadths above the symphysis. Beneath the fascia branches of the deep epigastric may be cut as they cross the median line to anastomose with those of the opposite side. Frequently a venous plexus lies on the peritoneum behind the lower third of the linea alba.

The external oblique is aponeurotic below a line connecting the anterior superior spines of the ilia.

Viscera. *Intestines:* Coils of small intestine occupy the front of the abdomen below the transverse colon, more or less covered by omentum. The jejunum is mostly to the left, the ileum to the right. The cecum, which is superficial, is in the right inguinal region. From it the ascending colon passes up to the hepatic flexure under the liver. The transverse colon crosses at a level just above the umbilicus. The splenic flexure is behind the stomach, in the left hypochondrium, at a higher level than the hepatic flexure. The descending colon is deeply situated and passes down to the sigmoid flexure.

The small intestine is divided into three parts: The duodenum, ten to twelve inches long; the jejunum, comprising the upper two-fifths of the remaining small intestine, and the ileum the lower three-fifths. The jejunum is of a brighter color, denser and smoother in structure, and of greater capacity than the latter. The transverse duodenum is more fixed than the other parts of the canal, and is, therefore, more liable to injury.

The points of distinction between the small and

large intestines are mentioned in the operation of appendectomy (q.v.)

Internal Hernia: The most frequent sites of retroperitoneal hernia are as follows: (1) Duodenal fossa, in the vicinity of the duodeno-jejunal angle. There may be an inferior (fossa of Treitz when vascular), and a superior (always vascular), or a duodeno-jejunal fossa formed when the duodeno-jejunal angle penetrates the root of the transverse mesocolon. This never coexists with the preceding.

(2) Sub-cecal fossa, under the ileum at the inner side of the cecum.

(3) Foramen of Winslow, the orifice of communication between the greater and lesser sacs. It is exposed by lifting the liver upward and to the right and forcing the intestines downward and to the left. It is below the caudate lobe of the liver and behind the first portion of the duodenum. Its anterior margin contains the portal vein, hepatic artery and common bile duct.

(4) *Fossa intersigmoidalis* at the inner surface of mesocolon and sigmoid flexure.

Stomach: When empty the stomach lies at the back part of the abdomen. The left lobe of the liver covers it partially in front, the under surface of the heart, separated by the diaphragm and pericardium, rests upon it above and in front. The cardia is opposite the seventh left chondro-sternal junction. The fundus reaches the sixth left costal cartilage. The pylorus reaches the upper border of the first lumbar vertebra to the right of the median line. The lower edge of the greater curvature extends to within two finger breadths of the umbilicus in the median line. The stomach is identified by its relations with the

under surface of the liver, its broad, smooth surface, pale color, dense structure, and characteristic arrangement of the blood supply.

Liver: The liver is made up of five lobes: right, left, spigelian, quadrate and caudate. The fissures are five in number. The *transverse* lodges the great vessels and nerves, and separates the spigelian and caudate lobes in front from the quadrate behind. The *umbilical* fissure is between the quadrate and left lobe, and lodges the round ligament. The fissure of the *ductus venosus* is between the spigelian and left lobes. the fissure of the *vena cava* separates the spigelian from the right lobe and contains the vena cava. The *fissura vesicalis* separates the quadrate from the right lobe and lodges the gall-bladder. Anteriorly the falciform ligament separates the right from the left lobes. It is connected with the posterior layer of the sheath of the rectus as far as the umbilicus.

Gall-bladder: The gall-bladder is situated in the fossa vesicalis; it is from three to five inches long, one-half an inch broad, and holds about an ounce. The position of the fundus is usually at the lower edge of the ninth costal cartilage on the outer edge of the right rectus muscle. To find the gall-bladder, after the abdomen has been opened, pass the finger outward over the anterior surface of the liver until the falciform ligament has been felt. Bring the finger to the free edge of the liver, then outward to the first indentation; this is the fissure of the gall-bladder.

Pancreas: The pancreas lies deeply in the abdomen, behind the stomach, in front of the second lumbar vertebra. The head is embraced by the duodenum and the tail lies in contact with the spleen. The organ may be exposed by raising the greater omentum,

transverse colon and stomach, and then dividing the lower leaf of transverse meso-colon.

Spleen: The spleen lies between the fundus of the stomach and the diaphragm, covered by the ninth, tenth and eleventh ribs. The *vasa brevia,* which are given off from the splenic artery just before that vessel reaches the spleen, should be avoided in the ligature of the pedicle.

Kidneys: A horizontal line passing through the umbilicus is below the lower edge of the kidneys. A vertical line from the middle of Poupart's ligament to the ribs crosses the kidney in its long axis, one-third of the kidney being to the outer and two-thirds to the inner side of the line. The right kidney is one-half to three-quarters of an inch lower than the left. The hilum lies on a level with the spinous process of the first lumbar vertebra, opposite a point two inches from the median line of the back. Parts of the duodenum and colon lie in front of the right kidney, part of the stomach, pancreas and colon lie in front of the left.

The usual relation of the structures entering the hilum is as follows: the vein in front, the artery in the middle, the ureter behind and toward the lower part.

Double renal veins are more frequently found than double renal arteries. Frequently an inferior renal artery is given off from the abdominal arch to the lower part of the kidney.

Ureters: The ureter is thirteen to sixteen inches in length and one-sixth of an inch in diameter. It may be partially or wholly double and be connected with the kidney above and the bladder below in various abnormal ways.

In the majority of subjects the ureter is narrowed at the following sites: (1) at a point one and a half

to two and a half inches from the kidney; (2) at the point of entrance into the bladder; (3) at the point of crossing the iliac artery.

The ureter rests on the psoas muscle, passing downward and inward, is covered with peritoneum, and is crossed from within outward by the ovarian vessels. The right ureter lies close to the outer side of the inferior vena cava. At the brim of the pelvis it is two inches from the left. Opposite the first piece of the sacrum it crosses the common or external iliac artery behind the ileum on the right and the sigmoid flexure on the left. In the pelvis it passes beneath the uterine artery in the broad ligament alongside of the cervix, three-fifths of an inch external to it at the level of the internal os. It crosses obliquely the upper third of the vagina and enters the bladder opposite the mid-point of the anterior vaginal wall.

Ovarian Arteries: These arise from the front of the abdominal aorta just below the renal artery. Each vessel passes downward and outward behind the peritoneum, resting on the psoas muscle, the right lying in front of the inferior vena cava, the left behind the sigmoid flexure of the colon. At the margin of the pelvis the artery passes in the infundibulo-pelvic ligament, coursing between the two layers of the broad ligament to just below the uterine extremity of the tube, where it anastomoses with the uterine artery. The ovarian artery may spring from the renal and aberrant renal artery.

The left *ovarian vein* empties into the left renal, the right into the inferior vena cava. Torsion of, or pressure upon the pedicle of the left kidney may cause a varicose condition of the venous plexus of the left ovary.

Uterine Artery: The uterine artery passes inward in the broad ligament from the anterior trunk of the internal iliac, courses downward and inward toward the cervix uteri, then upward between the layers of the broad ligament by the side of the uterus in a very tortuous manner, to anastomose with the ovarian.

Vaginal Arteries: The vaginal arteries may spring from the uterine, but the usual source is from the anterior division of the internal iliac.

MISCELLANEOUS POINTS.

All **wounds** should be handled as little as possible.

The **scalpel** should be held like a table knife, or violin bow, when making ordinary incisions. For fine dissection, it may be held like a pen. The edge of blade should be directed away from important structures.

Mouse-toothed forceps should not be used on the skin, when incising the peritoneum or when grasping tissue in the immediate vicinity of nerves and blood vessels.

Needles with sharp points and round shafts separate the tissue as they pass and make small openings; they are adapted to the sewing of serous surfaces. Needles with cutting extremities (Hagedorn) make smaller scars than ordinary surgeon's needles, the traction of the stitch tending to draw the edges of the needle-wound together. They should be introduced through the skin with the cutting edge at right angles to the wound, otherwise the suture will cause the puncture-wound to gap.

Sponges made of gauze are best. To dry the operative field, the sponge should be pressed gently but firmly upon the bleeding surface and quickly with-

drawn without rubbing. In cleansing the skin around the wound, all sponging should be directed away from the cut margin. A sponge that has been used to cleanse the skin should never be used in the wound.

Sutures should be introduced one-eighth to one-quarter of an inch from the cut edge. If too near they will cut through, if too far the edges will overlap or turn in. They should only be drawn sufficiently tight to approximate the edges of the wound. Stitches should be passed through skin and subcutaneous tissue so that the points of entrance and exit are equally distant from the cut edge. All knots should be midway between the puncture point of the needle and the edge of the wound.

The **primary incision** should be bold and clean cut, not nicked. It should be made (1) by introducing the point of the knife perpendicularly to the skin surface, then making the cut by lowering the handle and using the belly of the scalpel, and finishing the incision with the knife in the same position as introduced; or (2) by cutting with the belly of the knife and using scissors to divide the tissue up to the extreme limit of the incision in each angle of the wound.

The danger of infection is lessened if a separate knife is reserved for the primary skin incision.

Hemorrhage during an operation is treated on general surgical principles by forcipressure (clamping), ligature, torsion, gauze pressure or heat application.

Blood-vessels large enough to have a name should be ligated when cut. The twisting of smaller vessels is usually sufficient to control the bleeding (Dawbarn).

Adhesions. Recent adhesions, such as are met with in operations for acute lesions associated with

peritonitis, are soft and friable. They are best broken up with a gauze sponge or with the finger-tip. Old dense adhesions should always be broken up under direct inspection. They may be so dense as to require division with scissors, and so vascular as to demand ligation to control the hemorrhage.

In freeing adherent pelvic organs, the fundus and posterior wall of the uterus should be sought for first, from which the weaker points of cleavage are found and made the starting points of enucleation of the appendages.

Accidental Wounds of the Ureter. The ureter may be accidentally torn, cut or completely divided in the course of a pelvic operation. If the cut has been made in the longitudinal direction, the wound should be sutured at right angles to the line of incision in order to avoid the danger of stricture at the point of closure. In the case of a transverse cut, a longitudinal incision should be made at right angles to it, the angles rounded, and the wound sutured as in the longitudinal cut. Should the ureter be completely divided, it should be drawn down and fixed in the bladder through an opening made for the purpose, if such a procedure can be accomplished without undue traction.

If the part above the cut will not reach the bladder, the upper section may be inserted into the lower as follows: The distal portion of the lower fragment is ligated, a longitudinal slit made just below the ligature of sufficient size to admit the introduction of the upper fragment through it. The two ends of a suture of silk or fine chromic catgut are passed from within outward near the cut end of the upper section, the ends of the sutures threaded on fine needles which are then passed into the longitudinal opening in the lower

section and brought out again a quarter of an inch below the lower limit of the incision. By means of these suture ends the upper fragment is drawn into the lower, the ends tied and security against leakage insured by inserting interrupted sutures of fine catgut around the anastomotic union.

If union of the two segments with each other, or of the upper segment with the bladder is impracticable, the cut end of the upper may be temporarily sutured in the abdominal wound, nephrectomy being performed subsequently, when conditions are favorable.